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Parental anxiety during dental procedures in children under deep sedation: Anxiolysis with lavender oil and orange peel oil aromatherapies

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Abstract

Background/Aim: Deep sedation, used for dental treatment of uncooperative pediatric patients, create added anxiety in parents. It is important to reduce the anxiety of the parents for them to understand the post-procedure instructions and overcome the problems that may arise during their implementation, which will affect the recovery process. This study investigates the anxiolytic effects of lavender oil and orange-peel oil aromatherapies on the parents of pediatric patients undergoing dental procedures with deep sedation.

Methods: This randomized controlled study includes 90 parents who were randomly divided into three equal groups: Lavender oil (Group L), orange peel oil (Group O), and control groups (Group C). Group L inhaled the diffusion of 0.3 ml lavender oil in 120 ml water, Group O inhaled the diffusion of 0.3 ml of orange peel oil in 120 ml water, and Group C inhaled the diffusion of 120 ml of water. Parents completed the State-Trait Anxiety Index before the children were taken to the treatment room (STAI-1 and STAI-2) and after 1 hour of inhalation (STAI-1A).

Results: All three groups involved parents with similar demographic data. Parents in Group L who had children over the age of 5 years had higher anxiety scores after 1 hour of waiting (P=0.044). Also, the STAI-1 scores of unemployed parents in Group C were higher (P=0.021). In Group O, STAI-1A scores were higher than STAI-2 scores (P=0.038). The changes in STAI-1 and STAI-1A scores were similar between the groups (P=0.074).

Conclusion: Although no anxiolytic effect was observed, these methods were still considered promising. New research can be conducted with different settings and application regimes.

Keywords: Parents, Anxiety, Aromatherapy, Lavandula, Citrus sinensis

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Introduction

Anxiety is associated with pronounced psychological distress and can range from a minor ailment to extreme distress. Conscious/deep sedation is used as an alternative when nonpharmacological methods fail and routine dental treatments of children with intense anxiety cannot be performed [1]. Nevertheless, the induction of conscious/deep sedation causes additional anxiety about the procedure and carries the risk of not being able to regain consciousness. It is a stressful event often causing anxiety in the parents and may have harmful consequences for the intricately linked physiological and mental conditions of the child [2-4]. Also, this state of restless anxiousness of the parents may cause an inability to understand preoperative and postoperative instructions, which could prolong recovery time [4].

The physiological and psychological effects of essential oils have long been known in traditional medicine and aromatherapy. Lavender oil and orange oil fragrances are still popular and commonly found in households. The lavender plant belongs to the Labiatae family and has been used in dried form or as an essential oil for centuries. It is usually obtained from the flower head and leaves by steam distillation method [5]. The orange plant belongs to the family Rutaceae. Orange oil is obtained from fruit peels by cold pressing or distillation [6]. These oils are believed to have antibacterial, antifungal, muscle relaxant, sedative, antidepressant, and mood-lifting effects in traditional medicine and are beneficial for burns and insect bites [5, 6]. Essential oils have also been investigated for their anxiolytic features [7]. However, during the literature search, no study could be found investigating the anxiolytic effects of these oils on parental anxiety during the dental treatment of a child under sedation.

The purpose of the present study was to investigate the possible anxiolytic effects of lavender oil and orange-peel oil on parents of pediatric patients undergoing deep sedation.

Materials and methods

The Institutional Ethics Review Board of Ankara University Faculty of Dentistry approved this study (No. 09/05 ClinicalTrials.gov identifier NCT04079309), and the medical protocol of the study followed the Declaration of Helsinki.

This 3-armed randomized controlled trial was conducted at Ankara University, Faculty of Dentistry, Department of Pedodontics (Ankara, Turkey), with the informed consent of the participants. The inclusion criteria were being >18 years, able and willing to complete anxiety tests, and parents to children with indications for dental treatment under deep sedation according to the Frankl behavior assessment scale [8] (children with intense anxiety and cooperation problems and who could not be treated with the psychological approach methods). Parents with hypersensitivity to lavender and orange products, any psychiatric or psychological problems, those using any kind of medications, or those who did not agree to participate were excluded. As procedure times can vary, the procedural time for the pediatric interventions was 1 hour, and cases with a procedural time <1 hour were excluded from the study.

The study involved 96 parents, divided into three groups (Group L-lavender oil (n=30), Group O-orange peel oil (n=30), and Group C-control group (n=30)) using block randomization with a computer-generated program. The demographic data included age, gender, educational and occupational status of the parents and age, and concomitant diseases of the child.

To measure the state and trait anxiety scores of the parents, the Turkish State-Trait Anxiety Inventory (STAI-1 and STAI-2), which is effective in diagnosis and counseling in Turkey, was used. STAI-1 (evaluating trait anxiety) and -2 (evaluating state anxiety) were administered to the parents before the children were taken to the treatment room [9]. An essential oil vaporizer (TaoTronics) was placed in the 6 m^2 waiting room and activated 30 min before the participants entered. Lavender oil (*Lavandula angustifolia* Miller; Herba-flora, Ankara, Turkey), 0.3 ml diffused in 120 ml of water, orange peel oil (*Citrus sinensis*; Balen, Ankara, Turkey), 0.3 ml diffused in 120 ml of water, and 120 ml of water were placed in the essential oil vaporizer for Groups L, O, and C, respectively. The participants inhaled the room air with the essential oil vapors for 1 hour. The parents entered a waiting room once the children were taken into the treatment room. The second STAI-1 was readministered after 1 hour of a wait as STAI-1A. The parents completed the questionnaires at their own pace. They were not informed about the lavender or orange scents, as this may have affected the questionnaire results before completing the survey. However, all participants were informed about the study, and informed consent was obtained to use the data after completing the study.

Statistical analysis

Based on the results of previous studies, under the assumption that the mean (SD) values of STAI scores were 38.0 (10.2) and 42.3 (8.3), the paired t-test was used for sample calculation with a power of 0.80 at the significance level of 0.05. A minimum of 29 parents was sufficient for each arm of the study. The data analysis was completed with SPSS v11.5 software, Windows version (SPSS Inc., Chicago, IL, USA). Descriptive data were evaluated using mean (SD), and median (range), and the number of teeth (%) were used for qualitative variables. The data were not normally distributed; hence, the Mann-Whitney-U test was used to evaluate the quantitative variables and whether there was a difference between the two categories of qualitative variables. A one-way analysis of variance was used for normally distributed quantitative variables with more than two categories, and the Kruskal-Wallis H test was used for non-normally distributed quantitative variables. The Wilcoxon sign test was utilized to evaluate differences between two dependent quantitative variables. The relationship between two categorical variables was examined using the chi-square or Fisher's exact tests. Logistic regression was used to determine the risk factors affecting the qualitative variables in two dependent categories. A *P*-value <0.05 was considered significant.

Results

Six parents with a pediatric procedural time of <1 hour were excluded from the study. The final study population consisted of 90 (55 females and 35 males) parents. The CONSORT flow diagram is presented in Figure 1.

Figure 1: CONSORT flow diagram

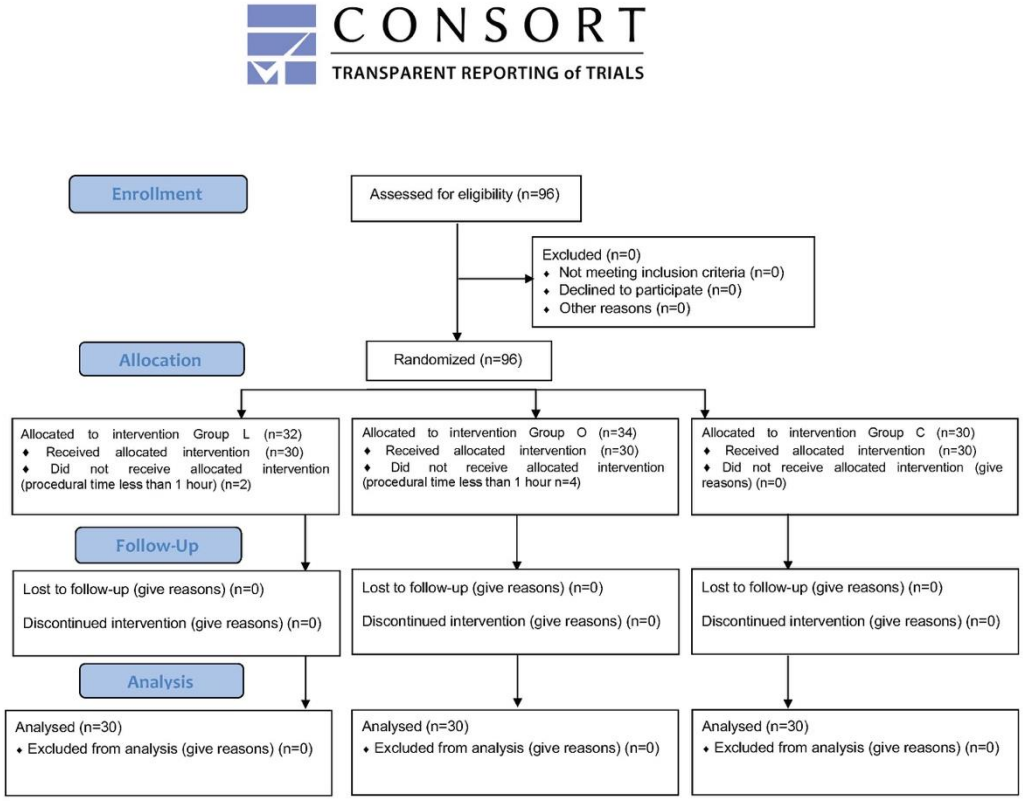

Table 1: The relationship between demographic data and distribution of STAI-1, STAI-2, and STAI-1A scores for Group L

Variables		STAI-1			STAI-2			STAI-1A		
		Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value
Age	18–40 (n=16)	44.81 (11.98)	43 (20–64)	0.252[a]	42.38 (10.83)	41.50 (22–63)	0.603[a]	40.75 (11.13)	41 (20–59)	0.803[a]
	≥ 40 (n=14)	40.21 (10.11)	41 (24–58)		40.93 (8.69)	39.50 (29–59)		40.71 (9.77)	43 (24–59)	
Gender	Female (n=16)	43.19 (11.06)	41(30–64)	0.967[a]	41.56 (9.63)	39.50 (27–63)	0.739[a]	41.63 (10.66)	42.50 (23–59)	0.588[a]
	Male (n=14)	42.07 (11.74)	43 (20–58)		41.86 (10.24)	41.50 (22–59)		39.71 (10.26)	42 (20–59)	
Educational Status	PSG (n=8)	44.13 (10.26)	41.50 (33–64)	0.664[b]	44.75 (11.13)	44 (27–63)	0.257[b]	42.38 (10.41)	42.50 (23–59)	0.856[b]
	HSG (n=11)	40.09 (9.35)	39 (24–58)		43.27 (9.05)	46 (29–59)		39.91 (10.06)	39 (28–59)	
	UG (n=11)	44.18 (13.83)	49 (20–62)		37.91 (9.01)	36 (22–56)		40.36 (11.40)	43 (20–58)	
Employment Status	Unemployed (n=10)	43.10 (9.94)	43 (30–64)	0.912[a]	43 (11.24)	44 (27–63)	0.809[a]	41.50 (11.02)	44 (23–59)	0.582[a]
	Employed (n=20)	42.45 (12.02)	39.50 (20–62)		41.05 (9.16)	39.50 (22–59)		40.35 (10.26)	42 (20–59)	
Age of the Child	< 5 (n=4)	35.25 (11)	37.50 (20–46)	0.246[a]	33 (11.34)	31 (22–48)	0.099[a]	31.75 (9.14)	34 (20–39)	0.044[a]
	≥ 5 (n=26)	43.81 (10.99)	43 (24–64)		43.04 (8.99)	41.50 (29–63)		42.11 (9.95)	43 (23–59)	
Additional Diseases of the Child	Autism (n=4)	42.50 (9.95)	44.50 (30–51)	0.309[a]	43.75 (12.15)	41.50 (33–59)	0.309[a]	46.75 (3.95)	47.50 (42–50)	0.078[a]
	Other (n=4)	36.75 (11.70)	37 (24–49)		38.75 (9.11)	39.50 (29–47)		34.75 (10.31)	35 (24–45)	

SD: standard deviation, a: Mann-Whitney U test, b: Kruskal-Wallis H test, PSG: primary school graduate, HSG: high school graduate, UG: university graduate

Table 2: Relationship between demographic data and distribution of STAI-1, STAI-2, and STAI-1A scores for Group O

Variables		STAI-1			STAI-2			STAI-1A		
		Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value
Age	18–40 (n=16)	44.56 (5.39)	46.50 (33–52)	0.452[a]	42.50 (7.71)	41.50 (30–64)	0.967[a]	44.44 (9.96)	42 (31–63)	0.532[a]
	≥ 40 (n=14)	45.57 (10.89)	48.50 (27–64)		42 (7.47)	43 (30–58)		41.64 (8.54)	42 (29–53)	
Gender	Female (n=18)	46.06 (8.10)	48 (30–64)	0.566[a]	43.28 (8.66)	42.50 (30–64)	0.471[a]	44.89 (10.27)	42.50 (29–63)	0.362[a]
	Male (n=12)	43.50 (8.65)	44.50 (27–55)		40.75 (5.21)	40 (31–48)		40.50 (7.15)	42 (29–53)	
Educational Status	PSG (n=8)	44 (7.05)	48 (33–50)	0.897[b]	41.38 (10.28)	39.50 (30–64)	0.338[b]	44 (11.33)	41 (31–63)	0.853[b]
	HSG (n=10)	46.90 (9.67)	47 (27–64)		44.60 (5.97)	44.50 (38–58)		44.10 (10.34)	43 (29–59)	
	UG (n=12)	44.17 (8.22)	46 (30–55)		40.92 (6.58)	41.50 (30–49)		41.75 (7.35)	41.50 (30–57)	
Employment Status	Unemployed (n=12)	45.67 (6.41)	48 (31–55)	0.865[a]	42.75 (10.01)	41.50 (30–64)	0.687[a]	43.67 (10.34)	41 (29–63)	10[a]
	Employed (n=18)	44.61 (9.47)	45.50 (27–64)		41.94 (5.49)	43 (31–49)		42.78 (8.78)	42.50 (29–57)	
Age of the Child	< 5 (n=10)	45.80 (7.04)	48 (31–54)	0.480[a]	43.30 (9.07)	42.50 (30–64)	0.775[a]	44.30 (7.60)	42 (37–63)	0.660[a]
	≥ 5 (n=20)	44.65 (8.98)	46.50 (27–64)		41.75 (6.74)	41.50 (30–58)		42.55 (10.14)	42 (29–59)	
Additional Diseases of the Child	Autism (n=2)	40 (14.14)	40 (30–50)	0.699[a]	47.50 (2.12)	47.50 (46–49)	0.121[a]	43 (8.49)	43 (37–49)	0.558[a]
	Other (n=5)	43.80 (11.61)	48 (27–55)		39.20 (6.34)	40 (31–47)		38.20 (11.26)	37 (29–57)	

SD: standard deviation, a: a: Mann-Whitney U test, b: Kruskal-Wallis H test, PSG: primary school graduate, HSG: high school graduate, UG: university graduate

Table 3: Relationship between demographic data and distribution of STAI-1, STAI-2, and STAI-1A scores for Group C

Variables		STAI-1			STAI-2			STAI-1A		
		Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value
Age	18–40 (n=23)	38.43 (8.55)	36 (21–57)	0.338[a]	37.78 (7.56	38 (20–54)	0.980[a]	40.13 (11.41)	39 (20–66)	0.220[a]
	≥ 40 (n=7)	42.14 (5.55)	43 (31–49)		37.43 (6.65)	40 (29–45)		35 (10.02)	33 (24–51)	
Gender	Female (n=21)	40.71 (6.61)	42 (28–50)	0.085[a]	38.95 (6.29)	39 (29–54)	0.212[a]	40.24 (9.79)	39 (20–63)	0.174[a]
	Male (n=9)	36 (10.33)	34 (21–57)		34.78 (8.83)	34 (20–49)		35.89 (14.01)	31 (20–66)	
Educational Status	PSG (n=3)	37.67 (5.51)	35 (34–44)	0.766[b]	42.67 (5.51)	40 (39–49)	0.329[b]	49.33 (15.28	46 (36–66)	0.091[b]
	HSG (n=13)	38 (8.28)	36 (21–50)		38 (8.55)	40 (20–54)		40.69 (9.14	41 (20–52)	
	UG (n=14)	40.86 (8.42)	43.50 (28–57)		36.36 (6.11)	34.50 (29–48)		35.07 (10.96	34.50 (20–63)	
Employment Status	Unemployed (n=11)	41.82 (6.69)	44 (32–50)	0.168[a]	38.55 (5.65)	39 (29–48)	0.620[a]	44.64 (8.97	45 (33–63)	0.021[a]
	Employed (n=19)	37.84 (8.53)	36 (21–57)		37.21 (8.14)	38 (20–54)		35.63 (11.15	35 (20–66)	
Age of the Child	< 5 (n=10)	36.20 (8.83)	35.50 (21–49)	0.234[a]	35.20 (7.73)	35 (20–48)	0.280[a]	41 (11.59	40.50 (20–63)	0.390[a]
	≥ 5 (n=20)	40.85 (7.34)	42.50 (28–57)		38.95 (6.86)	39 (29–54)		37.90 (10.08	36 (20–66)	
Additional Diseases of the Child	Autism (n=4)	45 (9.09)	44 (35–57)	-	34.25 (7.09)	32 (29–44)	-	33.25 (10.69	30.50 (24–48)	-

SD: standard deviation, a: Mann-Whitney U test, b: Kruskal-Wallis H test, PSG: primary school graduate, HSG: high school graduate, UG: university graduate

Table 4: Differences between STAI scores evaluating patients' state and trait anxiety according to groups

Variables	Group L (n=30)			Group O (n=30)			Group C (n=30)		
	Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value	Mean (SD)	Median (range)	*P*-value
STAI-1	42.67 (11.20)	41.50 (20–64)	0.829[a]	45.03 (8.27)	47.50 (27–64)	0.038[a]	39.30 (8.03)	39 (21–57)	0.185[a]
STAI-2	41.70 (9.75)	40.50 (22–63)		42.27 (7.47)	42 (30–64)		37.70 (7.25)	38.50 (20–54)	
STAI-1	42.67 (11.20)	41.50 (20–64)	0.085[a]	45.03 (8.27)	47.50 (27–64)	0.387[a]	39.30 (8.03)	39 (21–57)	0.900[a]
STAI-1A	40.73 (10.34)	42 (20–59)		43.13 (9.27)	42 (29–63)		38.93 (11.15)	37.50 (20–66)	
STAI-2	41.70 (9.75)	40.50 (22–63)	0.673[a]	42.27 (7.47)	42 (30–64)	0.484[a]	37.70 (7.25)	38.50 (20–54)	0.336[a]
STAI-1A	40.73 (10.34)	42 (20–59)		43.13 (9.27)	42 (29–63)		38.93 (11.15)	37.50 (20–66)	

Group L: Lavender oil group, Group O: Orange peel oil group, Group C: Control group, SD: Standard deviation, a: Wilcoxon signed-rank test

Table 5: Differences of STAI scores between groups

Variables	Group L (n=30)		Group O (n=30)		Group C (n=30)		
	Mean (SD)	Median (range)	Mean (SD)	Median (range)	Mean (SD)	Median (range)	*P*-value
STAI-1	42.67 (11.20)	41.50 (20-64)	45.03 (8.27)	47.50 (27-64)	39.30 (8.03)	39 (21-57)	0.050[a]
STAI-2	41.70 (9.75)	40.50 (22-63)	42.27 (7.47)	42 (30-64)	37.70 (7.25)	38.50 (20-54)	0.080[a]
STAI-1A	40.73 (10.34)	42 (20-59)	43.13 (9.27)	42 (29-63)	38.93 (11.15)	37.50 (20-66)	0.274[a]
STAI-1 - STAI-2	0.97 (10.44)	0.50 (20-26)	2.77 (8.87)	2.50 (19-24)	1.60 (7.66)	1 (18-22)	0.471[a]
STAI-1 - STAI-1A	1.93 (6.41)	2 (2-17)	1.90 (9.81)	0.50 (16-26)	0.37 (11.04)	0 (32-27)	0.704[a]
STAI-2 – STAI-1A	0.97 (10.60)	1 (22-21)	0.87 (10.29)	2 (23-29)	1.23 (8.92)	0.50 (17-19)	0.655[a]

a: Kruskal Wallis H test

Parents in the intervention groups reported no sensation of odor during or after waiting periods. No adverse events associated with the use of lavender and orange-peel oils were encountered. There were no statistically significant differences concerning age, gender, educational status, and employment status of the parents, and age, or comorbidities of the children between the two groups ($P>0.05$ for all). The relationship between demographic data and the distribution of STAI-1, STAI-2, and STAI-1A scores for Groups L, O, and C are presented in Tables 1, 2, and 3, respectively. In Group L, parents with children ≥ 5 years of age had higher STAI-1A scores ($P=0.044$). In Group C, unemployed parents had higher STAI-1A scores ($P=0.021$).

The differences between the STAI-1, -2, and -1A scores among the groups are presented in Table 4. The only difference was observed in Group O between the STAI-1 and STAI-2 scores ($P=0.038$).

Differences in STAI scores between groups are presented in Table 5. No differences were found between the groups concerning STAI scores ($P>0.05$ for all).

Discussion

A planned procedure is stressful not only for the child but also for the parents. Parents whose children will undergo an operative procedure feel elevated levels of anxiety and fear before the procedure [1-4]. These unpleasant sensations arise from a mixture of the child's illness, hospitalization, fear of anesthesia, and fear of the operation itself. Increased parental anxiety also increases the level of anxiety in children [10-12]. Recognizing and preventing the anxiety of the parents before the intervention will enable the information given to the parents to be understood more accurately, affect the treatment process positively and increase treatment satisfaction [7].

The most distraught group of children to undergo interventions under general anesthesia are those who are accompanied by extremely anxious patients. This condition of anxiety is reported to reflect on the first post-intervention week, affecting the parents' ability to care for their children, therefore affecting the healing process, the parents, and children, as well as the caregivers during the consultation and informed consent processes. For this reason, significant negative effects have been reported in pediatric settings [13, 14].

Literacy is another factor reflecting the understanding of health problems by parents. Increased literacy results in increased understanding, and literate parents will be able to implement the postoperative directives more effectively [15]. Although some studies report that parents with less education

have worse healthcare outcomes, other studies report a positive correlation between a parent's higher educational background and the level of anxiety [11, 12]. In our study, anxiety level did not differ with education. Charana et al. [11] associated higher anxiety levels with younger children (<5 years old). Also, female gender and younger parents correlated with higher levels of anxiety. In our study, parental gender and age differences were not associated with different anxiety levels. While parental anxiety was not affected by a lower-aged child in Groups L and C, a conflicting result was found in Group O. Parental anxiety was higher after 1 hour in parents with children >5 years of age. In addition, unemployed parents in Group C had higher STAI scores after the 1-hour wait. These conflicting results may be explained by socio-cultural differences between nations and communities.

Pediatric dental treatment is a stressful experience for a parent. The anxiety that a parent feels when their child undergoes general anesthesia was documented in the pediatric anesthesiology literature [1-3]. Unfortunately, managing parental anxiety and fear is quite challenging because the use of pharmacological agents, such as benzodiazepines, is not appropriate in such situations [10, 11]. A high STAI score indicates a high level of anxiety and vice versa. Average scores ranged between 36–41 [9]. In the present study, both state and trait anxiety of the parents were scored at a maximum of 64 points.

Most patients reported using prayer, massage, and herbal products to eliminate such anxious stress. These methods are preferred by patients because they have fewer side effects, and no detrimental effects on health have been reported [7]. The orange peel and lavender oil used in the present study have been investigated for such purposes but were not studied in a pediatric setting in parents with children undergoing deep sedation. Therefore, this study evaluated parental anxiety and whether orange or lavender oil would decrease the stress levels.

Conflicting results are presented in the literature. One study investigated 5 minutes of lavender inhalation aromatherapy as a way to reduce preprocedural anxiety and reported that aromatherapy was ineffective, whereas another study investigating lavender and rose oil inhalation aromatherapy effects on dental anxiety among orthodontic patients reported a significant decrease in anxiety levels [16, 17]. A study conducted in a dental office setting also found that inhaling both lavender and orange reduced anxiety and improved the mood of the patients [18]. The present study only detected tendencies toward differences in the lavender and orange-peel inhalation groups compared to the control group; however, the differences were not significant for several reasons. One may be the elevated level of anxiety parents felt for their children. Another reason may be related to the application method, duration, and amount of the essential oils used. In this study, the parents were blinded to the procedures before the study. Thus, the amount of essential oil applied was limited. The study was designed so that the parents would not notice the odors during administration and would not affect the STAI results. Lower anxiety scores may be obtained with larger amounts of essential oils. The working time was kept at 1 hour to ensure standardization. Longer exposure of the parents to the essential oils also may have caused different effects on anxiety.

Limitations & Strengths

A limitation that should be noted is that a single dose of 0.3 ml was selected for both lavender and orange peel oil applications, referencing other studies that achieved significant results. Since the effects of oils can vary with dose, it is recommended to determine the appropriate dose to be administered by gas chromatography.

A notable strength of the study is that aromatherapy applications were performed blindly. Since the scent of lavender is known to have a calming effect among the public, it was thought that this practice would affect the results of STAI if it was known by the parents, as in most studies in the literature.

Conclusion

The lavender and orange oil aromatherapy methods used in the present study did not have significant anxiolytic effects on parents. Nevertheless, a non-significant reduction in parental anxiety was detected. This promises that anxiety may be reduced with different administration methods, different durations, and a higher amount of essential oils.

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